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JUN 79
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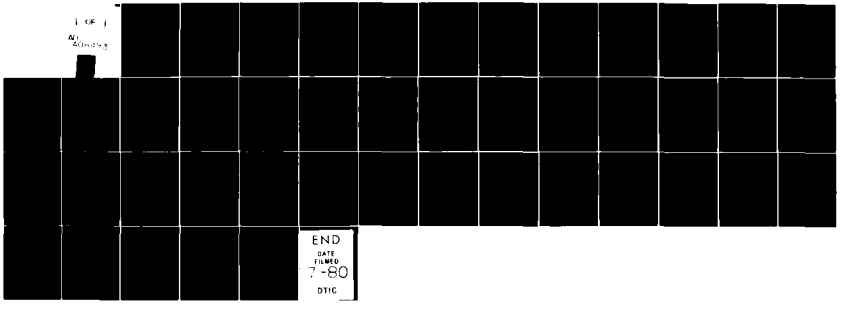

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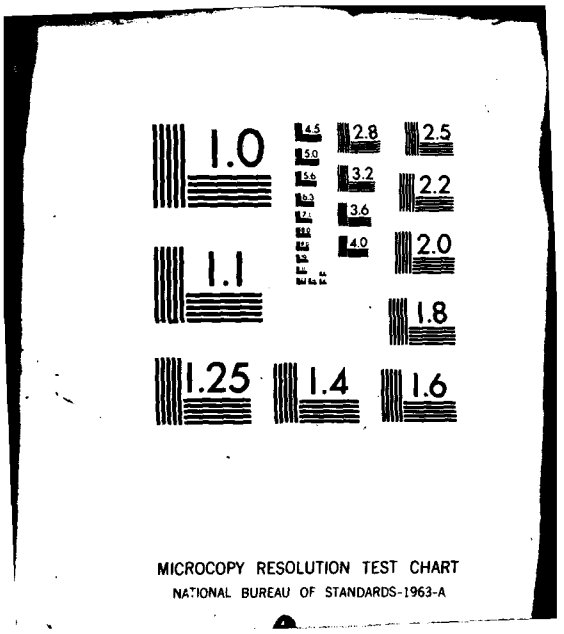
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ROYAL AIRCRAFT ESTABLISHMENT

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EDITOR'S SUMMARY

The Swedish Research Institute for National Defence issues a quarterly list of unclassified Reports published by the Institute. The titles of these Reports and informative abstracts have been translated in English. This volume is the first issue of 1978/79. Further volumes will be translated in due course. The main topics covered are: Protection - atomic, biological, chemical; ammunition and weapons; conduct of war, information and commands; vehicles and spacecraft; reliability and logistics; human factors; associated studies and their solutions; positive methods for limitation and control of armaments; psychology reports.

(18) DRIC EDITOR'S NOTE (19) BR-70072

The Reports are in Swedish unless some other language is indicated (usually English). When requesting Reports it should be appreciated that an English version will not normally be available, and that the prices of the original Swedish documents have not been indicated in this Translation. Reports may be obtained from:

FOA P Rapportredaktion, 104 50 Stockholm 80, Sweden

310450

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A PROTECTION - ATOMIC

A1 The nuclear weapon threat

(1) FOA report C40081-A1
Calibration of Pitman 235 S Milk Monitors
Arne Johnson and Ingemar Vintersved June 1978

To determine the content of radioactive iodine (^{131}I) in milk owing to suspected radioactive fallout, the National Foodstuffs Laboratory has bought 20 detector systems of the type PITMAN 235 S which are to be allocated to various dairies.

More than 90% of all milk is at present transported and stored in large milk tankers. This has meant a modification of the methods of measurement to determine the content of radioactive iodine in milk, devised during the 1960s and based on transport in containers of 20-50 l. The National Institute of Radiation Protection therefore wrote to the National Foodstuffs Laboratory on 29 November 1974 to suggest that measurements should be taken by drawing-off milk from a tanker into a special test flask containing a detector located at the centre of the flask. We would recommend however that the measurements be taken directly in the tanker cistern by immersing the detector in a Perspex tube into the milk. Apart from optimising the solid angle and sensitivity - in a normal-sized tanker with the tank full approximately the same speed of calculation is obtained as in a vessel of infinite dimensions - up to 80-90% reduction in the background radiation level is obtained. To enable the measurements to be made in any suitable cylindrical vessel sensitivity curves, which indicate deflection of the meter for the permitted limit of 2600 Bq/l (70n Ci/l), have been derived as a function of the diameter of the vessel and the liquid level (Appendix 1). Since particular circumstances may prevent the immersion of the detector in a milk container, some rough guidance is given for measurements made with the detector outside various types of vessel. Some guidance is also provided in correcting for background.

This research was undertaken at the instance of the research authority at the National Institute for Radiation Protection, Project SSI/P115.

B PROTECTION - BIOLOGICAL

B1 Threat scenario

(2) FOA report B40091-B1
Taxonomic groups of airborne bacteria. A summary (in English)
Per Ånäs and Åke Bovallius October 1978

Over the period of one year 674 bacterial colonies have been collected at random from microbiological samples of air. These, together with 15 known bacteria, have been characterised by 32 biochemical and other common

microbiological tests. The 'biological distances' between each of the 689 bacteria have subsequently been calculated from the results of these by means of a computer. An analysis of the distances demonstrates that the airborne bacterial flora is very heterogeneous, not being dominated by any one or a few types of bacterium. A numerical and taxonomic grouping yielded 19 fairly homogeneous groups, though 95 of the airborne, and 7 of the known bacteria, could not be assigned to any of these groups.

(3) FOA report B40092-B1
Three-year investigation of the natural airborne bacterial flora at four localities in Sweden (in English)
Åke Bovallius, Bengt Bucht, Roger Roffey and Per Ånäs

The concentration of airborne bacteria has been studied over a three-year period at four different localities:

(1) In an agricultural district (Närtuna) with a mean value of 99 bacteria/m^3,

(2) On the Baltic coast (Kapellskar) with a mean value of 63 bacteria/m^3,

(3) In a Stockholm park (the Humlegård) with a mean value of 763 bacteria/m^3, and

(4) At a major traffic junction in Stockholm (Stureplan) with a mean value of 850 bacteria/m^3.

The bacterial contents varied widely at all the sampling localities. The values at the Stureplan for instance varied between 100 and 4000 bacteria/m^3. There were large variations from one sampling to another though some seasonal variation was evident, the highest contents being during the summer and autumn. The importance of certain meteorological factors was investigated for the level of airborne bacteria. Rain and a high relative humidity were responsible for a reduction in the level of bacteria, while high temperatures and wind speeds caused an increase. Particle sizes were also determined; 50% of the bacteria-carrying particles had diameters greater than 8µm.

This investigation was partly financed by the Bank of Sweden's Jubilee Fund within the terms of the project for 'Aerobiological Research in Sweden'.

Offprint from Applied and Environmental Microbiology (1978), 35, pp 847-852; FOA Reprints 1978/79:9.

(4) FOA report C40076-B1
The PEST computer system (PRIME 300) at FOA 4. Procurement, commissioning and a description of its application to the on-line analysis of luminescence experiments
Björn Eriksen and Mats Könberg March 1978

A powerful mini-computer system, the PRIME 300, was procured in 1975 for FOA 4 and principally employed by the Institute for Applied Microbiology.

This Report contains an account of the configuration and the modifications made to the software for the purposes of FOA 4. The system is used with time-sharing systems for statistical calculations, word processing etc. In the collection of data from laboratory experiments with simultaneous display of the collected data on the oscilloscope, the computer is operated as a single-user system. It was found impossible to perform data collection as previously planned from several simultaneous experiments, owing to limitations in the system software.

This Report was written on the PRIME 300 with the text editing program EDIT, and printed-out by the RUNOFF program at a DIABLO type terminal.

B2 Protective measures

(5) FOA report C40072-B2
Some new analytical techniques for determining isoenzymes of human creatine kinase
Arne Lundin and Inger Styrélius February 1978

Some methods for measuring and separating human isoenzymes of creatine kinase are compared, on the basis of the literature references. Our own experiments in the measurement of bioluminescence in the activity of creatine kinase are reported together with methods for separating isoenzymes based on the ion exchange technique, immunological technique and different effects of the substrate content. We conclude that at present the most promising technique is to determine the bioluminescence of isoenzymes by means of specific inhibiting antibodies. This type of method would have both a much higher sensitivity than existing techniques and be sufficiently simple for routine clinical analyses. This method is undergoing further development.

The work has been performed with support from the Technical Development Board and the National Association against Diseases of the Heart and Lungs.

(6) FOA report C40078-B2
Figure of merit for a choice of photomultiplier. A comparison
Göran Bolander May 1978

The Report shows a method for comparing different types of photomultiplier with respect to specific data (amplification, dark current, quantum efficiency and area of the photo cathode), together with the effect of the dimensional geometry. Figures of merit were assigned to some 60 photomultipliers, which were ranked by means of a computer program. In order to illustrate better the effect of dimensional geometry, the figures of merit for six photomultipliers were plotted on a graph.

(7) FOA report C40085-B2
Comparative study of immunological methods for indicating and identifying micro-organisms or their products
Hans Erik Carlsson September 1978

The present article is a description of some practical immunological methods for rapid microbiological diagnosis. A rough comparison was made of the features of the method with a view to application under field conditions. There is wide variation in sensitivity among various methods. Only a few have a sensitivity high enough to be applicable without prior concentration of the sample. Analysis times vary from a few minutes to a few days. Sampling capacity varies from a few dozen samples per hour to several hundred, mostly depending on the level of automation. The methods which can be operated under field conditions without basic laboratory equipment are few, while some methods require special apparatus. A factor common to all methods is that a certain amount of microbiological knowledge is needed, the more advanced methods requiring special training.

(8) FOA report B40089-B5
Surface-decontaminating action of glutar aldehyde in the gas-aerosol phase (in English)
Åke Bovallius and Per Ånäs

The surface-decontaminating action of glutar aldehyde in the gas-aerosol phase was investigated for different temperatures and relative humidities. At a concentration of 15-20 mg/m^3 of air and a relative humidity of 80%, glutar aldehyde has a good effect against both vegetative bacteria (decimal reduction time 5 min) and bacterial spores (decimal reduction time 45 min). Despite its low volatility glutar aldehyde has proved to be more effective than formaldehyde, even when the same quantities of these materials are used for gas-aerosol decontamination.

Offprint from Applied and Environmental Microbiology (1977), 34, pp 129-134. FOA Reprints 1978/79:3.

B3 Injuries and treatment-biological

(9) FOA report B40076-B3
Luminescence reactions for microbiological analysis
Anders Thore

Offprint from Klinisk Mikrobiologi, STU Information No.54, 1977, p 123; FOA Reprints 1977/78:19.

(10) FOA report B40090-B6
Increased extra-cellular production of a cholinesterase-solubilising factor by Cytophaga NCMB 1314 during magnesium starvation (in English)
Åke Bovallius

A bacterium isolated at FOA has been used for solubilising cholinesterase from fish muscle. The solubilised cholinesterase was used in conjunction with studies of the indication of chemical warfare agents. The Report shows that solubilisation is caused by a factor which is located 90% extra-cellularly, probably associated with mucous material surrounding the bacterium. Magnesium starvation causes a 10-fold increase in the activity of this factor. Production of the factor can be stopped immediately by the addition of chloramphenicol. This indicates that increased production of the factor is dependent on active protein synthesis under culture conditions of magnesium starvation.

Offprint from Canadian Journal of Microbiology (1978), 24, pp 381-385; FOA Reprints 1978/79:4.

C PROTECTION - CHEMICAL

C1 Threat scenario

(11) FOA report B40073-C1
Investigations of dithienylglycolic esters. V Hydrolytic stability and preparation of some esters of glycolic acid (in English)
Gun Wallerberg and Börje Östman

Velocity constants for alkaline hydrolysis of esters of dithienyl, diphenyl and thienyl-phenyl glycolic acids were determined at +50°C, and the importance of certain structural parameters for variations in the rate of hydrolysis is discussed. Preparation of the esters is by a modified synthesising method.

Offprint from Acta Chem Scand (1976), Vol B 30, pp 900-902; FOA Reprints 1977/78:24.

(12) FOA report B40088-C6 (H5)
Kinetics of glutamate, glutamine and leucine transport in cultured neuroblastoma and glioma cells (in English)
Erik Walum and C. Weiler (U of Göteborg) October 1978

Membrane transport of the transmitter amino acid L-glutamate was compared with that of amino acids L-glutamine and L-leucine in cell cultures of neuroblastoma (C 1300, clone 41 A_3) and glioma (138 MG). It was found that L-glutamate was taken up in both cultures via a bi-affinity system (high and low), whereas L-glutamine and L-leucine were taken up via a mono-affinity (low) system.

The result agrees with the view that a high-affinity transport system exists only for amino acids having a neuro-transmitter function. The result also supports the theory that both glioma and nerve cells are of great importance for the secretion of transmitter amino acids from the synaptic cleft.

(13) FOA report C40079-C1 (H2)
Report on a study visit to institutes of environmental protection and civil defence in the Netherlands
Rolf Kallberg and Anita Meyerhöffer May 1978

A study visit was paid to the Netherlands in order to collect Dutch experience in disaster planning against chemical threats, the protective measures adopted and problems of civil defence for the study program 'Radioactive and chemical threats in emergencies and in wartime' (studies of toxicity).

Owing to its considerable chemical industry and densely built-up areas, the Netherlands have been obliged to adopt a much higher level of preparedness for emergencies than Sweden. Severe restrictions have been imposed on industries which are also required to provide assistance with industrial safety. However, the emergency provisions do not extend to wartime conditions.

Since 1971 the Netherlands have had a special department for environmental questions: the Department of Health and Environmental Protection. Large investments have been made in order to maintain an efficient watch on atmospheric pollution. Registrations have been carried out of the output, storage and surrounding structures of the chemical industry, together with toxicological assessments and assessments of the spread of gases, by means of field experiments and theoretical calculations. Altogether the result forms a good basis for analyses of danger, for example for newly commissioned industries and new building.

Holland has suffered a number of large-scale disasters, mainly at oil refineries. These disasters as a rule have been well documented and have contributed to the accumulation of knowledge before the initiation of planning.

Dutch civil defence has relatively small resources to protect the public in the event of a chemical distaster. Shelters exist for only one-tenth of the population, and gas masks for the public are not produced. Facilities for evacuation are also very few. Possible means of protection in built-up areas have been studied in the form of leakage tests as a substitute for shelter facilities.

(14) FOA report C40082-C1
Studies of the mechanism of 1-(2-thienyl)-silatrane
Karin Brandt and Hillevi Mattsson July 1978

Organic silicon compounds are usually without any biological effect. However certain silatranes cause convulsions and are highly toxic. The mechanism of this is unknown. The acutely toxic effect of 1-(2-thienyl) silatrane on rats (LD_{50} = 0.6 mg/kg) was studied in this investigation. The effects on γ-amino butyric acid (GABA)-medicated transmission and the effect on cyclic nucleotides in the central nervous system were also examined.

The result shows that the uptake and liberation of ^{3}H GABA in nerve-ends (synaptosomes) and Na^{+}, regardless of GABA-receptor bonding to synaptosomal membranes from rat brains, are unaffected by 1-(2-thienyl) silatrane.

The content of cyclic GMP in the cerebellum increased after injection, whereas the contents were unchanged in the cerebral cortex, subcortical parts and the medulla oblongata. The concentration of cyclic AMP was unaffected in any of the regions of the brain which were examined. Preliminary treatment with 3-acetyl pyridine failed to reduce the silatrane-induced increase of cyclic GMP, indicating that the increase is not dependent on activation of the ascending fibres to the cerebellum.

The anti-convulsive substances phenobarbital and diazepam reduced the increase of cyclic GMP. Phenobarbital (100 mg/kg) and diazepam (5 mg/kg) also increase the LD_{50} by 13 and 2 times respectively.

These results agree with those previously reported for bicyclic phosphates (Brandt et al, 1977). Convulsions due to silatrane compounds however are not quite identical with those caused by bicyclic phosphates.

C2 Protective measures

(15) FOA report C40077-C2 (H2, D2)
Determination of carbon monoxide and nitrous gases in a permanent defensive position during machine-gun fire
Åke Broxvall April 1978

Measurements were taken of the contents of carbon monoxide and nitrous gases to which a defending crew are exposed while firing the M/36 machine-gun. The experiment was a continuation of earlier measurements, and was undertaken in order to examine the consequences of the new safety regulations.

In every case the content of carbon monoxide during firing exceeded the health limits in force under industrial safety conditions. To a relative extent the nitrous gases represent no problem. The health limits were exceeded only under the least favourable conditions, using blank ammunition or the maximum rate of fire.

(16) FOA report C40086-C2
Routine methods for analysing chemical warfare agents from soil tests.
1. Analysis of nerve gases and mustard gas from soil samples
Sture Bergek August 1978

In order to devise some routine usable methods for analysing soil samples containing residues of chemical warfare agents, methods were designed at the first stage for analysing Sarin, Soman, FX and mustard gas and the decay products of these substances in soil samples. Suitable conditions were tried out for the extraction, formation of derivatives and gas chromatographic analysis.

Where chemical warfare agents are present in the soil, it should be possible to identify them in about one hour. When only the products of hydrolysis are remaining, the time for analysis is estimated at about three hours.

Products corresponding to 55-75% of the quantities originally deposited were recovered after 3 days from soil samples stored in a closed vessel at room temperature and 10% humidity.

(17) FOA report B40087-C6 (H5)
Effects of hexachlorophene on cultured cells from the nervous system. An informal lecture delivered at the annual meeting of the Swedish Biochemical Association, 28-29 November 1977 (in English)
Erik Walum October 1978

As a stage in developing alternative testing methods for neurotoxic substances, the effects of hexachlorophene were studied on neuroblastoma and glioma cell cultures. Results indicate that hexachlorophene affects the energy metabolism in cultured cells in the same way as in brain cells in vivo. While the biochemical changes were the greatest in neuroblastoma cells after exposure to hexachlorophene, the glioma cells underwent the greatest morphological changes.

(18) FOA report C40084-C6 (H5)
The establishment and characterisation of a transformed line of cells from rat livers
Erik Walum and Gun Ekblad August 1978

A line of cells resembling fibroblasts was established from adult rat livers. The intention is to use these cells for toxicological tests. The cells were cultured on a plastic surface in a synthetic medium (Hams F 10) in the presence of 13% calf serum. The cells had a viability of 92% 24 hours after the start of culture, and an adhesive power corresponding to 75% of the total number of cells placed in culture. During the logarithmic growth phase the doubling rate was 20 hours, and the terminal density was 350000 cells/cm^2. Average cell size was 24 μ for a cell density of 150000 cells/cm^2.

The most conspicuous feature of the morphology of the RLF cells was a well-developed fibril system, visible under a phase-contrast microscope. Experiments using cytochalasine B, colchicine and the substance which increases the intra-cellular content of cyclic adenosine monophosphate demonstrated that the system probably consisted of micro-filaments, which were responsible for maintaining the flattened morphology of the cells.

The high terminal density, which was due to the ability of RLF cells to grow in several layers, indicates that they had undergone a spontaneous transformation to a state resembling tumour cells. The results show that this change occurred between the 4th and 8th passage.

Although the RLF cells had undergone a transformation, they had retained their ability to regulate their store of glucose relative to the cell density. This is a property possessed by normal fibroblasts, but which is though to be lost by fibroblasts when transformed by means of a cancer virus. The experiments showed that the glucose uptake was reduced by a factor of about 5 when cell density increased from 1000 to 150000 cells/cm^2, which may indicate that cells in dense cultures have undergone a biochemical differentiation.

D AMMUNITION AND WEAPON TECHNOLOGY

D1 Technology of explosives

(19) FOA report A20030-D1
Development of the personnel safety organisation. Results of a research program with cooperation at three workplaces in the explosives industry
Kurt Baneryd (Industrial Safety Board) and Urban Kjellén September 1978

A research program with cooperation in the study of working environments was undertaken between April 1975 and October 1976 at three plants in the explosives industry. One of the objects of the program was to list a general body of problems concerning methods and difficulties involved in developing a protective organisation. The purpose was to make better use of the experience of personnel in safety practice and to create conditions for a stronger commitment and effectiveness. Another object was to increase the knowledge of those taking part (management, production staff and experts) of various requirements of the working environment and of ways of cooperating on safety matters.

A team under the safety committee with representatives of staff and management was responsible with the research staff for the detailed design of the research program at each of the three plants. The team also took an active part in various parts of the program, partly by discussing problems of the working environment on the shop floor and by devising precautionary practices for them.

The methods employed in the research program (including the investigation of breakdowns, interviews concerning risks at work and participation by personnel directly involved in the work of the team) were found to be suitable for taking advantage of ideas of the staff from their own experience. The research program covered an intensive learning period chiefly for shop-floor personnel, but also for the other partners concerned in the study teams. On the other hand the traditional roles were modified only to a limited extent. As a rule no supplementary resources were devoted to environmental measures at the workplaces in question. In many cases however it was found possible to make more

efficient use of the available resources, including improving communication among production management, experts and production personnel by means of the study teams. This activity also resulted in a number of technical and structural safety measures.

(20) FOA report A30014-D1
Ammunition safety in the vicinity of laser operation
Tore Bergqvist et al April 1978

At the instance of the Defence Services Materials Laboratory the effect on the safety of ammunition during the operation of lasers was reviewed. A list was drawn up accompanied by an evaluation of the properties and technical data of existing and future lasers for defence applications. The radiation levels at which various kinds of effect are expected to occur in ammunition were listed with reference to the published literature and to direct experience of the effects of optical radiation on materials. The danger of direct radiation effects from communications-related lasers, as used for example in rangefinders and surveillance or target-tracking systems, is felt to arise only when directed at very close range against igniters or some other sensitive material. For the combat-type of laser, eg 10 kW CO_2 lasers, the danger exists of igniting eg packing materials at relatively long range. In the case of TEA lasers, some very substantial electromagnetic transients can be generated.

D3 Rocket engine technology and associated ballistics

(21) FOA report C20252-D3
Halogen oxidising agents for hydrogen rocket engines
Erik Sivsjö August 1978

The chemical and physical properties are summarised for some commonly-occurring halogen compounds. Chlorine trifluoride is treated in greater detail in view of the development of the research task. Comparisons of theoretical performance between various combinations of propellant are presented in tabular and diagrammatic form. It is evident that a considerable gain in performance can be obtained by using halogens in place of conventional oxidising agents.

Since chlorine trifluoride was considered to possess the most attractive properties, this substance was chosen as the fuel, together with hydrazine for purposes of practical research. From an initial study of the properties of halogen compounds, the use of such substances as rocket engine fuels can be readily seen to be very complicated. The FOA research program however has found this not to be the case. Any difficulties arising in the course of the entire research program were overcome by relatively simple means.

The design of rocket engines is briefly described, with a summary of results of the research, and they can be summed up as follows. No mishaps, failures or accidents occurred. The mean values for improved performance achieved amounted to about 14% for the specific impulse and 28% for the density impulse. These values are based on comparisons with earlier experimental results obtained with highly-concentrated fuming nitric acid as oxidising agent and a mixture of amines (hydyne) as the fuel.

D4 Technical aspects of warheads

(22) FOA report B20016-D4
A model for thick-target projectile penetration based on instrumented pressure-bar recording of penetration forces (in English)
Åke Persson

A simple model was formulated for the deceleration of a rigid sphere striking at right angles a relatively thick target, proceeding from explicit expressions for the elastic-plastic resistance of the target and its frictional and inertial resistance, and for the edge effects on the impact surface and rear surface of the target. An experimental arrangement is described in which a 'target' was fired against an instrumented pressure-bar. Strain-gauge transducer outputs from a run of such experiments at different velocities enable the parameters of the model to be determined, and the results of investigating two types of target material (soft and hard aluminium) are presented.

Control tests were made by firing steel balls at aluminium targets. Path-versus-time curves as determined by flash X-ray recording are in good agreement with those calculated by a computer program based on the theoretical model. Further developments of the model using different target materials and forms of projectile, oblique impacts and deformed projectiles are also discussed.

FOA Reports, (1977), 11, No.3.

(23) FOA report B20017-D4
A theoretical and experimental study of the penetration mechanics of rigid projectiles (in English)
Åke Persson

This article is a continuation report of a study presented at the First International Symposium on Ballistics, Orlando, Florida, 1974, the purpose of which was to formulate a simple model of the penetration of a sphere into a relatively thick target. The first section of this continuation study consists of a theoretical investigation of parameters to illustrate the effect on the penetration process due to variation of the parameters such as impact velocity, the intensity of edge effects, density of the projectile and the physical properties of the target. In the second section the model is generalised to cover all

forms of nose. Values of the parameters in the penetration model were determined by special experiments, in which the penetration power was measured as a function of depth of penetration by an instrumented pressure-bar. The third section contains some results of these experiments, in which the thickness and diameter of the target and the form of the projectile nose were varied. The Report concludes by applying the penetration model to an explanation of why a slender heavy-metal projectile is bent after penetrating obliquely-angled armour plate.

FOA Reports (1977), 11, No.4.

(24) FOA report B20018-D4
Precursor delay in 1060 aluminium (in English)
Torkel E. Arvidsson et al

This Report deals with one of the projects undertaken by one of the authors (TEA) as a visiting research scientist at Washington State University, Pullman, Washington, USA.

The research was devoted to studying the decay of a shock wave in a material in order to draw conclusions as to the mechanism by which dislocations occur. The material studied was polycrystalline, pure commercial aluminium. On the discovery of vigorous bending of the elastic precursor, interest became centred on interpreting this phenomenon. It was demonstrated that the bending was an effect of viscosity.

Offprint from J Appl Phys (1975), 46, pp 4474-4478; FOA Reprints 1977/78:22.

(25) FOA report C20251-D4
Penetration of a shaped charge jet in water. A test firing
Ingegärd Mellgard August 1978

Object: To investigate the penetrating power of a shaped charge jet in water.

Method: 14 shots were fired against three target arrangements. In two cases 300 mm of water were placed between a first target plate and a stacked target of 10 mm plates, with the water either directly under the first plate or directly upon the target stack. In the third arrangement the water was omitted; otherwise it was the same as the other two, ie with a 1200 mm spacing between the first target plate and the stack. The idea was to simulate a fuel tank in an armoured vehicle.

Result: 300 mm of water corresponded to about 100 mm of commercial iron, regardless of the location of the water. In this case it agrees well with the theory, which states the formula for penetration by a shaped charge jet

(g_1 and g_2 respectively) in two different materials (1 and 2) is

$$\frac{g_1}{g_2} = \frac{\text{density}_2}{\text{density}_1}$$

(26) FOA report C20255-D4
Comparative studies of missile explosions by flash X-ray experiments and machine computation
Åke Sjögren August 1978

The computer program *TODEP* can be used for studies of the ejection phase in the process of a controlled explosion. The reliability of the program for wide-angle controlled explosion processes was verified by performing comparative experiments and calculations.

Controlled explosive charges with wide-angle metallic inclusions were detonated and recorded by flash X-ray equipment. Parallel computer programs were run using the same geometry. These resulted in plotted patterns which can be compared with the flash X-ray images. The comparison which covers both form and position exhibits good agreement between the two methods. The deviations which occurred are systematic, and so slight that the *TODEP* program can be considered reliable enough for use where it is required to study the parameters in similar geometries.

A shortened version in English, intended for 'Proc of the 4th International Symposium on Ballistics, October 1978, Monterey, California' is also available.

(27) FOA report C20256-D4
Experiments with single-stressed concrete slabs subjected to shock-wave stress in air
Ingemar Johansson August 1978

A series of experiments were performed at FOA 284 covering 16 tests with single-stressed concrete slabs subjected to shock-wave stress in air. The results consist of recordings over time of stress, bending, acceleration, reaction by the bearing supports and crack formation.

The Report includes the results of these experiments and a comparison with results of a computation from mathematical models.

The bending process in the slabs was compared with that calculated from the model *ENFRI*, having one degree of freedom. *ENFRI* proved to be quite good as a description of the bending process. The reaction curve as measured in the bearing supports was compared both with the results calculated by *STEUL*, which is what is termed an Euler beam model, and also with the results calculated by *ENFRI*. None of the models affords a good agreement for the entire process,

although *STEUL* can be used to obtain an estimate of the maximum support reaction, while *ENFRI* provides a relatively good picture of the overall process.

(28) FOA report C20257-D4 (A3)
Experiments with light concrete walls subjected to a shock wave in air
Ingemar Johnsson and Kjell Edin August 1978

A series of experiments was performed with the object of studying the dynamic properties of light concrete walls when subjected to a shock wave in air. Two different types of wall were studied: first a length of wall consisting of cemented and stressed light concrete blocks, so as to give rise to camber effects under transverse loading, and secondly free-standing reinforced wall elements of light concrete. Some static experiments were also made.

Stresses in the wall due to an atmospheric shock wave were recorded in the experiment, together with the processes of bending, acceleration, support reaction and crack formation. The stresses were varied for different experiments. Two destructive tests were also made.

Comparative calculations were also made with the *ENFRI* model in one degree of freedom. On multiplying the measured static function of resistance by a factor of the order of 1.2-1.8 the model was found to describe the bending process well. One condition for the model in one degree of freedom to be able to give a good agreement is for the relation between bending and the static load to be well known. However it was found that the models available for calculating the relation between static load and bending give poor agreement with the results of static experiments. It is therefore recommended to find mathematical models for light concrete walls which give an accurate relation between bending and static loads for large amounts of bending also. Alternatively a static experiment can be performed for each type of wall which has to be calculated for stressing by an atmospheric shock wave.

(29) FOA report C20258-D4 (D8)
GIPZ - a small set of interactive routines adapted to the GCS package (in English)
Inge-Lill Brattegy-Ribbing August 1978

Some interactive routines from *GIPZ* have been adapted to the GCS graphic system.

The Report describes these routines at the levels of the user, operator and executant.

(30) FOA report C20260-D4
Visit report of the Convention Informatique, 1977
Ulf Rozén September 1978

The Convention Informatique (CI) is the largest data-processing conference in Europe, and is held in Paris every autumn. The list of papers read

covers various subjects; among those particularly well catered-for in 1977 were computer networks, databases and distributed data-processing. 'Systems' are often a keyword, and many types of system were discussed (eg administrative, economic, technical, information etc).

The Report presents a number of aspects of C1-77; it describes first its aims and organisation, then gives a number of summaries of lectures attended followed by an attempt at evaluation.

Several aspects of data-processing in France have been assembled from conference activities, brochures and other material received: some of the larger software houses are described, together with the names of some computers and journals. This is supplemented by a short glossary of French data-processing terms and 14 illustrations.

(31) FOA report C20261-D4
Physical principles of warheads
Bo Janzon September 1978

The Report covers projectiles, missile warheads, fragmentation heads, their effects and the underlying physical phenomena. It forms the basis for a compendium used at the Military College, the Army technical course on weaponry, but it is used also eg for other purposes at the Military College.

(32) FOA report C20262-D4
ENFRI: a computer model for computing the bending and reactions in bearing supports for single-stressed concrete slabs subject to atmospheric shock waves
Ingemar Johansson and Inger Åseborne September 1978

What are termed models in one degree of freedom are commonly used to calculate the maximum flexure in structures when subjected to atmospheric shock waves. These models are based on the principle of converting an actual system to a similar one having one degree of freedom.

The *ENFRI* computer program has been compiled as an aid for interpreting the results of experiments on single-stressed concrete slabs subjected to atmospheric shock waves, as conducted at FOA 284.

ENFRI is used for computing the bending process in the slab and the process of reaction in the bearing supports.

The Report is designed to present both the principle of a model in one degree of freedom and an example of how this model is applied.

D6 Protection from exploding warheads

(33) FOA report C20263-D6
Experimental arrangement to test the effect of fire on shelters in small dwellings
Leif Nilsson September 1978

The Report describes an experimental arrangement intended for use in studying the effect of fire on shelters in small dwellings due to the transfer of heat from a fire in the dwelling above to the ceiling of the shelter. The design of the equipment is based on assessments of the combustion process in a typical brick and timber dwelling house, on estimates of fire stress in such buildings and on a documented knowledge of the combustion of timber under various fire conditions. The Report concludes with two experiments using the experimental apparatus.

E CONDUCT OF WAR - INFORMATION AND COMMAND TECHNIQUE

E1 Reconnaissance target location and fire control

(34) FOA report A30015-E1
Automatic interpretation of hand-drawn circuit diagrams (interim report)
Roger Cederberg April 1978

The Report describes the first part of a project financed by STU (Stockholm Technical University) for developing an automatic read-in system for hand-drawn circuits. This Report covers the detection and interpretation of the graphic element. A subsequent Report will deal with the combination of textual and graphic information.

The work is being carried out on PICAP a special processor for image-processing, at the institute of systems engineering, LITH. The author wishes to thank Professor P.E. Danielsson and his colleagues for their generous cooperation.

(35) FOA report B30026-E1, E3
Studies of the 0.5-14 µm optical extinction due to atmospheric aerosols (in English)
Arne Hågård et al

Aerosol extinction constitutes one source of uncertainty in predicting atmospheric attenuation of infra-red radiation. We describe variations in aerosol attenuation in the boundary layer of the atmosphere using a model which firstly takes account of effect of meteorological parameters such as visibility, humidity and the type of air mass on a bimodal distribution of particle sizes consisting of two-log normal distributions, and then determines the aerosol-related extinction by Mie's theory. We adapt the model to the results gained by simultaneous measurements close to ground level with a transmissometer for several wavelengths and with meteorological instruments, including a nephelometer (point visibility meter) and a precipitation gauge. The transmissometer measures attenuation in the atmosphere over a 500 m long horizontal path in 15 bands in the range 0.5-14 µm. A complete sequence of transmissometer readings and meteorological data is automatically obtained for each 10 min period.

Preliminary results show the expected increase in aerosol attenuation with increasing atmospheric humidity and decreasing wavelength, which agrees with the model predictions. Whether the observed variations in aerosol attenuation as a function of wavelength agree with the effects of the weather as predicted by the model, cannot be verified until a larger database has been established.

Offprint from Radio Science (1978), 13, pp 277-284;

FOA Reprints 1978/79:1.

(36) FOA report C20259-E1 (E4)
ANPASS - a part of the system of matching and producing weather forecasts
Ulf Rozén September 1978

The Report describes the *ANPASS* system, which constitutes part of the operational system of MVC for numerical weather forecasting, NWP (4). This activity is part of the collaboration by FOA with MVC. The description is presented at the systems, data and programming levels, and includes specifications for the programs employed (but without listings). Input data to the system are a number of analytical and forecasting fields transmitted electronically from the forecasting system of SMHI. The SMHI field is converted from the SMHI grid to that of MVC, and a number of special MVC forecasts are also calculated.

ANPASS is at present being run on a SAAB D23, but will be transferred to a UNIVAC. The Report also contains a suggestion for how to do this.

(37) FOA report C30127-E1
The role of time and bandwidth parameters for a matched receiver operation in reverberation noise (in English)
Magnus Herold and Lars Götherström June 1978

The signal-to-noise ratio (SNR) at the output of a receiver for underwater communication is studied, including disturbance due to reverberation noise. Three type of signal are used: PCW, LFM and PRN. The signals are described together with channel fluctuation in terms of their properties with respect to time and bandwidth, thus affording simple expressions for the SNR.

(38) FOA report C30134-E1
VHRR - three programs for processing satellite signals from NOAA 4 and 5
Gerd Erlefjord April 1978

The Report describes three computer programs for the search, editing and copying of given portions of signal which represent parts of the total VHRR signal.

The VHRR programs were developed at the instance of Ingvar Akersten of FOA Section 356.

The programs were written in FORTRAN IV for the IBM 370/165 with OS/MVT at the Stockholm Computer Centre (QZ).

This work was performed as part of the activity in connection with the processing of remote sensing data at FOA 335, and was partly funded by the National Commission on Space (DFR).

(39) FOA report C30137-E1
Situation Report 15 February 1978: Hydroacoustic Image-plotting
Ludvig Mossberg April 1978

The project constitutes No.3, section 1, of the overall program for Marine Engineering between FOA and STU.

During the latter half of 1977 and early 1978 the following studies were received, which are important for the future development of the project.
Theoretical investigations:

(a) Range calculations at present-day frequencies and power levels have shown that a transmitter power of 500 W (400 W acoustic power) gives ranges between 10 and 30 m depending on the turbidity of the water, and in the 0.5-0.7 MHz frequency band. Market research is proceeding for the procurement of amplifiers usable up to 2 MHz.

(b) The resolution power of the hydroacoustic lens system was investigated. At 10 m observation range objects 5 cm apart can probably be distinguished using reasonable lens diameters (0.75-1.0 m) and frequencies (0.7-1.5 MHz). It should be possible to detect their complete outer contours.

(c) A comprehensive investigation of beam paths through the lens has been and is being carried out. Besides our own exploratory computer program, a large FOA 2 program is being used in *SIMULA*. Errors due to aberration and coma can be allowed for a given lens system, although no mathematical methods are available for finding the optimum lens system. Diffraction is the most serious of the five remaining types of error discussed in an optical context. There is a lack of programs to investigate phase differences in the focal plane. However lens experiments can be started and lenses manufactured using the knowledge we now possess.

Experimental activities:

Properties of materials: Acoustic attenuation, the velocity of sound and acoustic impedance have been obtained in tank trials for three types of silicone rubber and for Delrin, a nylon-type material. Experiments on lenses were resumed in February 1978.

Electronic design:

An interface with an image store, capable of generating a colour image from the Alpha-LSI-2 computer, has been designed and is under construction. A bought-in TV has been modified with printed-circuit boards for any desired choice of colour → pressure level.

Mechanical design:

A test stand is under construction and will be capable of adaptation to the FOA-sub. The stand will form a framework for the acoustic camera and all its components. It will be possible to use it on trial runs in the tank of Branch 350.

Programming:

This is a continuing requirement, for visual presentation of acoustic pressure displays, for design operations, and also for developing control programs for hydrophones and arrays which are movable in the focal plane of the camera.

(40) FOA report C30138-E1
Recursive scan processing for estimating edges in noisy images (in English)
Dan Andrée and Åke Wernersson April 1978

The Report deals with noisy image data, in which the direction of scan is not completely parallel with the edges whose position it is required to determine. A number of adjacent image lines are added in order to arrive at a signal-noise ratio of about 1. A recursive scan of image lines is performed, using results connected with estimates of state for Markov chains. This method of estimating has been tried in a large number of cases, achieving very good agreement with visual estimation. For a signal-noise ratio of about unity, the uncertainty in determining position becomes about two image elements. This method differs significantly from conventional methods using some kind of pattern matching.

This work was partly funded by the Defence Research Institute.

(41) FOA report C30143-E1
PICCOLA - An interactive aid for multilayer digital image processing (in English)
Rolf Wastenson and S. Ingvar Åkersten June 1978

The computer program at FOA 355 for the digital processing of multilayer image data forms a library of sub-routines. An operating routine, a black data sub-routine and job control sets are required to form a complete job. *PICCOLA* is a procedure written in the *GUTS* order code which, when interfaced with the user, composes this type of job.

PICCOLA is run on the *GUTS* system with an IBM 370/165 at the Stockholm Computer Centre.

(42) FOA report C30144-E1
A frequency selective CO_2 laser reflector based on quartz (in English)
Britt Hartmann August 1978

The emission of a CO_2 laser is usually strongest in the 10 μm band. Emission at a wavelength in the 9 μm band can be optimised instead by a resonant reflector as described in this Report. The frequency selectivity of the reflector is governed by frequency-dependent IR reflection in quartz. The danger of laser damage to the reflecting surface has been estimated. Crystalline quartz is more durable than fused quartz owing to its higher reflection coefficient and thermal conductivity.

The reflection coefficient of crystalline quartz at 9.3 μm is further increased by coating it with an optically thin layer of ThF_4 and ZnS, without seriously impairing the frequency selectivity of the reflector. When treated in this way, a quartz reflector can be used in CW lasers with 10W output power, and in pulsed lasers ($\tau \sim 0.1$ μs) of $\cong$ 0.1-0.5 MW output power with optimised resonators. For special purposes a quartz reflector may serve as a cheap and suitable alternative to a lattice or surface-coated germanium reflector.

E2 Communications

(43) FOA report C30142-E2
Description of a microwave refractometer
Gunnar Johnsson May 1978

The microwave refractometer is used to determine the refractive index of air. The construction of the microwave refractometer used at FOA 345 is described in the Report. It also includes detailed drawings of the installation of the refractometer in the A32 028 aircraft at FMV-F:T .

E3 Guidance, navigation and target identification

(44) FOA report C20254-E3
Tests with a ruggedised fin-servo and a pressure-feedback hydrazine gas generator
John Sundelin and Wigert Sonered August 1978

The project, which was designed to enlarge our knowledge of hydrazine gas operated fin-servos, has now been completed (for first part see FOA 2 report C20092-E4, February 1976).

The tests were performed by pressure control of the hydrazine gas generator. The method is to cause a pressure transducer to control a simple two-position valve in the hydrazine inlet, known as a bang-bang system. It yields a quite acceptable performance under pressure and pressure transient.

The fin-servo was operated both on compressed air heated to 500°C from a furnace built for the purpose, and with hydrazine gas. The servo was made to function well even for short periods up to 5-10 min.

Tests were also made with the servo cooled down to -40°C, causing starting problems among other things owing to valve freeze-up. It was possible to prevent this in the test by allowing the gas to pass through a small amount of alcohol.

For some tests at the end of the series the gas consumption (the working volume of the servo) was evaluated at different operating temperatures.

The hydrazine tests were conducted in conjunction with No.270 Branch, Ursvik.

(45) FOA report C30141-E3
Hydroacoustic navigation and position-finding
L. Gotherstrom June 1978

The present Report is a summary prepared subsequently of a paper Delivered to the National Association of Swedish Mechanical Engineers on 7 February 1978. It describes the properties of a hydroacoustic transmission channel and their effects on navigational errors.

E4 Countermeasures, including signal interception and technical intelligence

(46) FOA report C30133-E4
Investigation of an all-pass network with pulse and transient attenuation
Torbjörn Karlsson and Sven Garmland March 1978

A filter circuit has been designed which allows a sine-wave signal to pass, but attenuates transients or pulses. The filter has a frequency-dependent delay which causes the energy content of a pulse to be spread over time. For a sine-wave signal or some other signal of small bandwidth the frequency-dependent delay will have no effect. The Report describes how a step function having different rise times was distorted by the filter. The measured values agree very well with calculations. The construction of the filter, its measurements and theory and computer calculations are discussed in detail.

E5 Technical reliability

(47) FOA report C20250-E5
A literature study of the kinetics and mechanism of inhibition in the oxidation of hydrocarbons
Göran Åquist August 1978

The Report is a literature study of the effects of inhibitors and mixtures of them on the oxidation of hydrocarbons. After a general account of the principle of the reaction the conditions are described for inhibition by the effect of different inhibitors, followed by a description of the mechanism of the inhibition of oxidation by the effect of mixtures of inhibitors. Particular attention is devoted to the accompanying synergisms.

(48) FOA report C20265-E5
Stable storage for petrol. Examination of the reaction rate as a function of temperature using a model substance
Ingemar Ohlsson and Göran Åquist September 1978

In order to verify previously obtained temperature relations to predict the stability in storage of petrol, a number of tests have been performed with cumene containing AIBN as the initiator and α-naphthol as the inhibitor. The mechanism of the reaction and the velocity constants for this system are known, enabling us to compare the calculations of reaction rates and induction periods with experimental results under conditions similar to those of petrol storage. The results show that the previously estimated storage times for petrol are of the right order of magnitude.

F VEHICULAR AND SPACECRAFT TECHNOLOGY

F8 Reviews and threat scenarios

(49) FOA report C20264-F8
Remote-controlled and re-usable spacecraft and vehicles. A literature study
Stina Palme September 1978

Remote-controlled spacecraft and vehicles of various forms can be both airborne and ground-based for one-time or multiple use. The latter category, multiple use, has been designated in Sweden by the collective term RPV (remotely-piloted vehicle).

The present Report gives an account and description in summary of an assortment of objects which are considered to be representative or of particular interest in a general survey of developments. The sources are a selection of research projects which are accessible in the open literature, and which have been edited and compiled.

F9 Materials

(50) FOA report C20253-F9 (E4)
Optimising tests using dielectrometry for the autoclaving of laminates
Fritz Larsson August 1978

Experiments have been made to gain experience in the production of fibre composites in an autoclave, by the trial of a newly developed technique, dynamic dielectric analysis. This affords better means of controlling the curing process so as to produce composites of higher and more uniform quality than by earlier methods. The method does not supply any general criterion for control, but it requires a thorough study of every plastics system.

H HUMAN FACTORS

H2 Hostile environments, closed units, field hygiene

(51) FOA report C30136-H2
Classification and calculation of safe distances: rangefinders using ruby or neodymium lasers
Tore Bergqvist et al April 1978

We have reviewed the basic conditions and physical concepts needed in order to be able to apply a system of classification and to make calculations of safety distances for pulsed laser rangefinders using ruby or Nd-YAG.

No other types of laser are discussed. Through this specialised approach, tables of limiting values for injurious radiation, other fundamental information and instructions for procedures in calculation and measurement have been considerably reduced compared with those previously existing in international laser standards

Five laser types of current concern to FMV have been classified, and safety distances were calculated. In the interests of giving a concrete account the mathematical method in certain cases is performed in detail.

(52) FOA report C40083-H2
Smoke candle m/52 - a toxicological study of the literature
Karin Brant July 1978

A perusal has been made of the literature on the substances contained in the combustion products of smoke candle m/52. Available information shows that the candle contains no substances of serious toxicity when used normally. Nor should these products constitute a source of risk in the case of single contact in the open air, although continual and daily contact may be likely to cause some injury.

(53) FOA report C54023-H2
Effect of solvents over various prolonged periods on the physical activity of mice
C-O. Criborn and M. Gullmetz October 1978

The present investigation on mice having access to a treadmill to evaluate prolonged physical activity has shown that this is important for the level of injury arising through exposure to solvents and for recovery after such treatment.

The animals were exposed to solvents for one or two periods of four or five nights with a subsequent recovery period of six days.

Benzene (ca 70 ppm) causes a considerable reduction in work output and a reduction of body weight throughout the period of treatment. Sensory reactions were impaired after the fourth night of treatment.

Methylene chloride (about 10 ppm) and methyl ethyl ketone (about 100 ppm) mainly affect sense reactions during both treatment periods without any noteworthy effect on body weight. Treadmill activity was reduced during the third and fourth nights in the first treatment period. During exposure to methylene chloride it was lower than normal during the second exposure period.

During this time the animals exposed to methyl ethyl ketone exhibited almost normal activity, whereas their sensory reactions attained their lowest value. Regardless of which solvent was tested, injury increases with duration of treatment while recovery is more complete for active mice.

H3 Environmental extremes

(54) FOA report A30018-H3, M6
Remote sensing as an aid to navigation in ice-covered sea areas (in English)
Ragnar Thóren June 1978

After a brief historical summary (Chapter 1) the author describes ice reconnaissance and sea patrols by photographic means, including the institution of an 'International Ice Patrol' in the most heavily-affected areas of the North Atlantic during the iceberg season, (Chapter 2). In the next chapter (3) the importance of remote sensing for under-ice navigation is described. Chapter 4 deals with applications of electronics to the reconnaissance and charting of ice etc, covering radar, microwave radiometry, IR scanners and low-light TV, side-ways-looking radar and the use of satellites for studies of ice, measurements of its thickness etc. This also contains a section on Southern Ice Limit Charts and information on the notable Ice Experiment of the Soviet atomic icebreaker SIBIR in May-August 1978. Various applications of remote sensing in Fenno-Swedish ice research in the Gulf of Bothnia in March 1975, operation Sea-Ice-75, is briefly discussed in Chapter 5. Finally in Chapter 6 the author presents some information and opinions on the historic voyage by the Soviet atomic icebreaker ARKTIKA to the North Pole in August 1977, which yielded ample data on the construction of large merchant vessels in the icebreaker class and the planning of new shipping lines, all of which is extremely important for the exploitation of the natural resources of the Arctic.

To all 300 participants in the Symposium on Remote Sensing, Commission VII, International Photogrammetric Society, Freiburg, West Germany, 2-8 July 1978.

(55) FOA report B58002-H3
Preventive effect of a vasodilator on the occurrence of decompression sickness in rabbits (in English)
Ulf Balldin and Mats Linér

The effect of the vasodilator terbutalin (β_2 stimulator) on the occurrence of decompression sickness was studied in seven rabbits. The rabbits were subjected to 2 atm, they were then given oxygen at 1 atm and were finally subjected to 0.2 atm. Hypobaric exposure was prolonged until symptoms of decompression sickness were obtained. The animals were again subjected to the same process of exposure (after at least 1 week's interval), but now at the start of the period terbutalin was adminstered at 1 atm. Decompression sickness could be produced in the injected animals in only one case, and only after a long dwell time, as distinct from the control group in which they all quickly suffered decompression sickness during the exposure to low pressure.

Offprint from Aviation, Space and Environmental Medicine (1978), 49, pp 759-762. FOA Reprints 1978/79:8.

(56) FOA report B59006-H3
Explosive decompression of subjects up to 20000 m altitude using a two-pressure flying suit (in English)
Ulf Balldin

The two-pressure flying suit produced in Sweden for life-support in high-altitude flight was tested for various aspects of medical safety. The suit is capable of an adequate oxygen supply at high altitude up to 70 mm Hg (9.3 kPa) respiration at over-pressure by pressure on the rib cage and by 3.2 times greater pressure in the g-trousers. Ten experimental subjects after breathing oxygen for 1 hour in a low-pressure chamber were subjected to explosive decompression from 9000 m to 17500 m and 20000 m in 0.5 s. No symptoms could be observed of decompression sickness or rupture of the lungs with gas embolism to the central nervous system. Lung X-rays after the tests indicated no cases of ruptured lungs with leakage from the lungs to the chest cavity, cardiac cavity, the mediastinum or to the skin. In only one case a few intra-cardiac bubbles (termed silent bubbles in the bloodstream) could be detected by ultrasonic Doppler effect in one subject after explosive decompression to 20000 m.

Offprint from Aviation, Space and Environmental Medicine (1978), 49, pp 599-602. FOA Reprints 1978/79:2.

(57) FOA report D58001-H3
Norwegian advances in diving
J. Adolfson et al October 1978

Visits were paid to diving centres at Bergen and Stavanger, where questions of medical engineering and organisation were discussed. During the last five years large investments have been made throughout the diving sector in Norway, with the concentration being shifted from the Navy to commercial diving firms and to governmental or semi-governmental civil institutes.

The navy was absolutely dominant in the field ten years ago, and the installation at Håkonsvern in Bergen was then well-equipped and modern. Subsequently a certain stagnation appears to have occurred. Even though some basic equipment for deepsea diving has been procured in recent years, no activity in this area has yet undertaken and qualified staff are tending to move into the civilian field.

Civilian diving has developed rapidly owing to North Sea oil production. From the outset this activity was dominated by foreign firms, although Norwegian diving firms have sprung up in the last five years, three of them being located in the Stavanger area (Three X, Scan-Dive and Seaway Diving). Equipment in the form of vessels, diving chambers etc which they possess is well up to that of the major international firms. The same applies to diving methods and depths.

The governmental or semi-governmental civilian institutes have displayed an increasing interest in diving in recent years. A large investment has been made in organising the Norwegian Underwater Institute in Bergen, which was inaugurated in the spring of 1978. A wide program of research and development has been presented both in diving medicine and techniques. Plans are afoot at the institute to undertake training in deepsea diving.

It is interesting to compare diving activities in Norway and Sweden. In Sweden the defence services have not only succeeded in retaining a dominant position but have even strengthened it in recent years. The Swedish Navy is now building an installation broadly corresponding to the Norwegian Underwater Institute. Civilian requirements for advanced diving are still relatively few in Sweden, while they are very great in Norway. Meanwhile manpower reserves in experience and knowledge of diving are large in Sweden, while they continue to be limited in Norway, especially as regards research facilities for diving medicine.

H5 **Emergency treatment, rehabilitation, preventive medicine**

(58) **Studies at Tuve of medical emergencies, 30 November 1977**
Kaare Brandsjö et al

H6 **Individual and group efficiency**

(59) **FOA report B52001-H6**
Psychophysiological circadian rhythms in women during 72 h of sleep deprivation **(in English)**
Torbjörn Åkerstedt and Jan E. Fröberg

Physical and mental reactions in 15 women belonging to voluntary defence organisations were studied during three days of continuous activity without sleep. The physiological measurements and subjectively estimated alertness exhibited a very pronounced circadian variation, peaking in the afternoons and registering a minimum in the small hours. Performance in a firing practice also

varied significantly on the same pattern. The data were compared with the results of an earlier study of male subjects in the same situation. Both men and women exhibited practically identical circadian variations, the sole difference being that subjective estimates of fatigue and stress by the men increased in the course of the experiment, which was not the case with the female group.

Offprint from Waking and Sleeping (1977), 1, pp 387-394.

FOA Reprints 1978/79:5.

(60) FOA report C50601-H6
Factors influencing a prolonged foot march (in English)
Åke Dalén et al September 1978

The object of the research was to identify the factors affecting endurance on the march. A normal company of infantry (n = 114) were tested in conjunction with a march of 20-26 km. The march was made by platoons at a mean speed of 4-5 km/h. The troops were wearing ordinary FSMO without arms. The march was partly by road and partly across country. Immediately after the march each man was questioned about sensations of fatigue, pains in various parts of the body, trouble with his equipment etc. Altogether 90% of them made complaints serious enough to require a medical examination. Injuries were mainly confined to the feet (n = 59), the majority being blisters and abrasions (20%) and weakness of the arches (30%). Back pains occurred in 10 cases. A questionnaire carried out one week before the march the questions included the men's attitude to military service and military marching. These variables were found to bear a statistically significant relation (r = 0.25-0.35) to endurance on the march. However no such relation was found to exist between endurance and general physical condition (measured as the maximum powers of oxygen intake as calculated from a recording of heartbeat frequencies during a sub-maximum cycling test). To summarise, the investigation showed that the men's greatly reduced performance after the march was mainly due to local injury, principally to the feet and calves and not to any generally poor condition (aerobic capacity) as such. Injuries could probably have been reduced by a more regular march training and an improved design of boot.

(61) FOA report C55018-H6
Effect of transcendental meditation on the degree of neuroticism as measured by the defence mechanism test
F. Paul Johansson August 1978

The purpose of the investigation was to study any effects from transcendental meditation practised over a period on the degree of neuroticism as measured by the defence mechanism test (DMT). The group selected for the test were 15 candidates for pilot training in the Air Force. They had all been failed

for inadequate DMT results, though otherwise considered very suitable by the Air Force Selection Board. They were offered a re-test if they would first practise TM or some other technique supposed to influence the mind, eg yoga or self-training. They all agreed and said they intended to start with TM. Seven of them considered themselves later to be prevented for mostly practical and physical reasons, so they claimed, from fulfilling their intentions. They were tested nevertheless, and they take the place of a previously planned control group. Their results were compared with those of the eight who were practising TM. While the results at the first testing had been similar, the re-test results showed a significant departure to the advantage of the practitioners of TM.

The conclusion drawn from the investigation is that TM can have some effect on the degree of neuroticism, as measured by DMT.

(62) FOA report C55020-H6
The dimensioning and validation of the defence mechanisms of percept-gener[illegible]. A hierarchical analysis of pilot behaviour under stress
Thomas Neuman October 1978

The object was to examine the practical use of the results of the defence mechanism test as a predictor for adaptation to activities as a military pilot.

Proceeding from psychoanalytical and percept-genetic theory and a study carried out in several stages to improve objective standards of evaluating results, a theoretical model was constructed of the relationships among the various phenomena which are displayed in DMT results. This model formed a basis for a new system of standards, NORM 78.

NORM 78 was applied by ex-post facto statements covering a period of 6-12 years concerning a population of 760 pilots whose test results and observed suitability had been partly used in drawing up standards, including NORM 78, and also a population of 225 pilots whose test results had not previously been used.

The DMT results were formulated as the NEUMAN PILOT INDEX (NPI), in two parts, the NPI, GFU and NPI PILOT, and were validated against the respective criteria: pass/fail in GFU and matched/mismatched in the service after GFU.

The outcome was that NORM 78 was found to possess a higher validity (r_b = 0.50) than standards used previously. Wrong predictions in the 225 material were 7% ($p < 0.001$) for the worst 27% NPI PILOT values. All six failures of the 136 pilots in the 225 material who were passed in GFU belonged to the NPI classes 1-2 (= worst-poor prospects) ($n = 63$; $p < 0.01$). Out of the 17 rejections by GFU encountered in the material, 15 fell in NPI classes 1-2, 2 in classes 3-5 (=good-best prospects) ($N = 73$; $P < 0.001$).

The conclusion of this research is that, in general when evaluated by NORM 78, the DMT results are probably a useful predictor for adaptation to the military flying service. DMT, which has been used in the Air Force since 1970, may be held mainly responsible for the fact that the percentage of wastage in GFU for regimental officer cadets fell from 64 in years 1967-1969 to 18 in years 1975-1977. It is impossible to determine precisely the level of responsibility for DMT as against other measures adopted at the same time, in terms of reduced wastage. What is known as the parallelistic postulate of percept-genetic theory as to the relation between reactions of the test subject to certain elements in the test and actions experienced in certain stages of life was confirmed.

(63) FOA report D55009-H6
Manpower placement and comparability studies of labour requirements in sawmill employment
Bertil Mardberg and Kurt Baneryd August 1978

Comparability estimates were used in order to study whether a person's own job situation is of importance when considering the requirements for employment in a sawmill, such as eyesight, physical stress, change and variety, responsibility for the end-product and the working process, and opportunities for conversation at work with fellow-workers.

Three levels of seniority in a sawmill were represented as assessors, ie managers, technicians and labourers. Fifteen jobs were considered.

Comparability matrices were studied in terms of structural similarity among the groups of assessors. Cluster analysis was used here to reduce the number of stimuli.

No clear connection could be identified between the position of an assessor in the organisation and his assessment of various jobs. The study disclosed further problems of method which need to be solved.

H7 Testing and job analysis

(64) FOA report B57006-H7
Prevalence of migraine and cluster headache in Swedish men of 18 (in English)
Karl Ekbom et al

The occurrence of migraine, cluster headache and other headaches (NMH = non-migrainous headache) was investigated in 9803 unselected 18 year old males from eastern Central Sweden, by means of a special questionnaire. Personal interviews with over a fifth of those claiming to suffer recurrent headaches demonstrated that diagnoses based on this questionnaire were high reliable. 4.4% of the men suffered from recurrent headache: 1.7% had migraine, 0.09% had cluster headache and 2.6% were suffering from NMH (eg stress headache).

The majority had headaches quite often, but only 43% of migraine cases and 32% of those with NMH had consulted a doctor for their complaint. 14% of migraine cases and 11% of NMH cases were using analgesics daily or almost daily. 15% of the migraine cases had used ergotamine tartrate. Only four of the nine cases of cluster headache had consulted a doctor for their headache, and a correct diagnosis was made in only one case. Recurrent headache is not uncommon in men liable for military service, and it may reduce their efficiency. Periods of cluster headache are probably very debilitating. The questionnaire technique may very likely be found to be of practical value as a complement to the medical examination before call-up for compulsory military training.

Offprint from Headache, Vol 18, pp 9-19. FOA Reprints 1978/79:6.

(65) FOA report B57007-H7
Physical characteristics and allergic history in young men with migraine and other headaches (in English)
Richard Schêle et al

The physical characteristics and information on allergies for 436 18 year old males with migraine and other types of headache were compared with corresponding information on 18 year old men without headaches. It was possible to establish statistically significant differences between the mean group values for variables such as body length, isometric muscular strength and physical fitness. These differences however were slight. No statistically significant differences were found between the groups for variables such as weight, bone structure, blood pressure, and acuteness of vision and hearing. Allergies to food substances were more frequently claimed by migraine cases than by those suffering from other types of headache or free of headache, although asthma and allergies to pollen were reported by about the same proportion in all three groups.

Offprint from Headache, Vol 18, pp 80-86 1978. FOA Reprints 1978/79:7.

(66) FOA report C55019-H7
Outline of a model for the analysis and description of work, drawn from central psychological functions
Jan Lindell August 1978

Considerable knowledge of humans is now available, from psychological, social and medical standpoints. This knowledge affects in various ways our views on work and also the form and content of descriptions of work. Any such description should therefore be derived from an overall view of the human subject. This means that the job itself is set in relation to the organisation as a whole, to the man and his social environment. The factors considered are presented in an 'Outline model for job analysis'. A person's behaviour is described in terms of an information-processing system. Cognitive aspects are important for human

behaviour, eg in decision-making. However in many instances emotional factors play a dominant part. Work analysis must therefore study how both these factors affect the working process.

H8 Training procedures

(67) FOA report D55011-H8
Report on the 13th International Symposium on Applied Military Psychology, Lahr, West Germany, 25 April 1977
Staffan Wikström September 1978

The annual symposium on applied military psychology which in 1977 was held at the Canadian military HQ at Lahr in West Germany was attended by three representatives from FOA 5. The purpose of the visit was to gain an oversight of international research in this field.

It was found that research in military psychology operates at various levels and deals with different problems in different countries, owing partly to the following factors:

(1) The general development of democracy in the country

(2) Whether there is a standing army or general conscription

(3) The position of the research organisation and its liability to influence from the Defence services.

In addition to the scientific reports and papers which were delivered and discussed, some reviews were presented concerning the structure and hierarchial position in the Defence services of the organisations for research and military psychology of those countries taking part in the symposium.

(68) FOA report D55012-H8
Report on the 14th International Symposium on Applied Military Psychology
Gunnel Frenzel-Norlin and Alise Weibull October 1978

The Report contains abstracts of fourteen papers read at the 14th International Symposium on Military Psychology, which the authors attended in April 1978. The themes of the symposium were 'Leadership' and 'Crises of authority in society and the Services'. Despite some weaknesses of organisation the overall benefit of the symposium was very good. The greatest interest was provided by contributions from representatives of Canada, Israel and Sweden. More detailed documentation is available from the Institute of Behavioural Sciences, FOA 55. Compare Report D55006-H8 and D55007-H8, June 1978.

(69) FOA report D55013-H8
An improvement program for a workplace. A measure of organisational development
Nils Forander and Anders Risling

The Report describes how a program of improvement was undertaken at a place of work during one day, results of a questionnaire and a follow-up after

about a half-year. An account is given of the theoretical principles, both the general theory of organisational development and some Swedish and foreign military experience of organisational development.

The program had a positive reception by the participants. In the follow-up six months later is found that many measures were adopted with reference to the program, although some obstacles arose in carrying out some other measures. The program is applicable to all workplaces in the Defence services.

H9 Man and machine systems

(70) FOA report C56017-H9
On laws of brightness discrimination (in English)
Hans Marmolin September 1978

The present study compares two laws of brightness discrimination $\Delta I = k(I + I_o)^p$ and $\Delta I = k.I^p + I_o$, , using data from studies of brightness discrimination previously reported. Both these laws described the data on brightness discrimination satisfactorily, but only the former was capable of predicting also brightness discrimination in the region of $\Delta I \sim$ constant. However the results of this indicate that the latter law is to be preferred, since the parameters of this law were systematically related to variables of the situation, such as the ΔI surface, presentation time etc.

M INTERDISCIPLINARY STUDIES AND INVESTIGATIONS

M2 Environment and social studies

(71) FOA report C10092-M2
Injury to society by warfare - how can it be assessed?
Petter Wulff et al May 1978

How is it possible to assess the damage which warfare is capable of inflicting on society? This question has been asked by the Directing Board for economic defence at the FOA. It is discussed in this Report from seven different standpoints. The discussion is on a general level. There is almost a complete absence of quantitative data on the possible extent of such injury. It is hoped that a reader of the Report will realise why uncertainties in many cases render the calculation of injury meaningless.

The object of the Report is to stimulate discussion. It is addressed to everyone who is engaged on or interested in economic defence or civil defence.

The Report was compiled by Petter Wulff. The contributions by other authors can be found from the table of contents.

(72) FOA report C10095-M2
Chinese policy on research and education since Mao: an ideological review
Torbjörn Lodén June 1978

The 4th National People's Congress (January 1975) took as its objective for economic policy to build up China by the year 2000 into a 'modernised and strongly socialist state'. The overriding objective for the policy of the present Chinese leadership is to create a highly-industrialised socialist society with a strong military capability. The important means to achieve this end are the modernisation of agriculture, industry, defence and science and technology (known as 'the four modernisations'), and 'the key to the four modernisations lies in the modernisation of science and technology'.

The present scientific and technical resources of China are considered by the political leadership to be inadequate. A new policy for research and education was presented after the death of Mao. Its objective is a substantial development in quantity and quality of Chinese technical and scientific resources. More than most of the other practical and political questions in China, the new policy for research and education has been drawn into the ideological debate. An important question in this debate is whether the new policy for research and education will favour the rise of a new privileged stratum or a new ruling class. Should any such class develop - according to one theme in the debate - it might jeopardise the opportunities for research and education to make the best contribution to the development of production.

M3 Predictive planning

(73) FOA report C10090-M3 (E5, H9)
Computer-assisted teleconference systems
Jacob Palme May 1978

Computer-assisted teleconference systems are expected to become important and widespread during the 1980s. They afford an opportunity for contact and collaboration within groups numbering from 5-100 geographically separated individuals, at considerably lower expense than by travelling and ordinary meetings. Energy costs are also far less than for meetings combined with travel. However computer-assisted systems ought not to be thought of as a substitute for normal meetings, since they provide a new type of communication. They rather resemble a little newspaper which appears daily within a small group, on which all the participants can cooperate.

Experience shows that these systems provide completely new opportunities for contact and cooperation, which without these systems were not possible at all. FOA intends to implement one such system for communication within FOA in connection with re-locations as decided by Parliament.

Computer-assisted teleconference systems may be expected to play a large part in management and planning, especially in situations requiring quick decisions, where information has to be conveyed rapidly and where the participants are geographically separated. The system may also be important in the future for the direction and planning of defence, in peace, watime or an emergency. This Report describes the operation and properties of computer-assisted systems, gives an account of how FOA is planning to use such systems, presents a general functional description of the system now in course of development, and discuss the possibilities for research in social psychology in order to gain better knowledge of the scope for applying this type of system.

No conclusions are drawn about how the social-psychological research and evaluation, as described in the Report, are to be performed.

(74) FOA report C10094-M3
Naval forces in a future European war between East and West: a technical and strategic study
Walter Wicklund February 1978

Within the terms of a requirement levied by the Department of Defence on the FOA concerning the effect of technology on a future war in Europe, a technical and strategic study has been undertaken of the importance of naval forces. The effect of technology on naval systems was studied in the context of the responsibilities of the naval forces. Some opinions are expressed as to the possible utilisation of naval systems in wartime.

(75) FOA report C40075-M3
Information on the software developed for the PEST mini-computer system
Bjorn Eriksen March 1978

The Prime 300 mini-computer system, known as PEST, at FOA 4 is used both for laboratory activities (single-user system for data collection) and as a general-purpose mathematical computer for several simultaneous users. PEST comprises a number of hard-wired terminals and an on-call 300 baud modem line.

This Report describes the modifications and additions made to the standard software, and contains listings of the documentation on various programs which exists in the form of what are termed the *HELP* files in the system.

This Report was written with the aid of *ED*, the textual editor of Prime, and then edited by the *RUNOFF* program and printed-out on a DIABLO keyboard terminal.

M4 Systems and program planning

(76) FOA report B20007-M4
On the determination of the Perron root (in English)
Torsten Ström January 1976

The Report discusses various methods for numerically determining the Perron root and the corresponding eigen-vector. Some techniques based on inverse iteration are discussed in detail. An algorithm is proposed which also allows for possibility of the matrix being reducible.

FOA reports (1976) 10, No.1.

(77) FOA report C30139-M4
Directory of Swedish organisations engaged on naval research and technology
Bengt Granath April 1978

The the request of the Ministry of Foreign Affairs, FOA has undertaken an investigation into the development of marine engineering. The unclassified part of the Report includes a list of Swedish authorities and organisations responsible for naval research and technology. This list may also be of use to other interested parties in the field, and is accordingly published as a Report under the FOA program entitled 'A review of developments in naval research and engineering'. The compilation is in the form of a catalogue of about 150 firms, authorities and institutes by name, address and telephone number, with condensed information on the type of activity pursued. It concludes with a list of sources which have been drawn upon.

T CERTAIN MEASURES FOR LIMITATION AND CONTROL OF ARMAMENTS

T1 Seismological multiple stations

(78) FOA report B20015-T1
Multivariate linear functional relationships. Estimation of parameters and discrimination between two relationships, with a seismological application (in English)
Eva Elvers

A series of five statistical investigations is described, and their origin which is a seismological discrimination problem is briefly presented. The first item deals with the estimation of parameters by the method of maximum likelihood and a modification of this for a class of models for which the traditional theory for large samples cannot be used owing to what are termed random parameters. Models of functional relationships fall under this heading, and the series continues with a more detailed study of the preparation of asymptotic estimators for multivariate linear relations. In the third article a general comparison is drawn of two distriminants based on samples. The fourth item uses its two predecessors to state a rule of classification for two parallel relations and to calculate their properties. Finally various different methods are examined of including also a censored variable in the classifying procedure. The successive links in this series have been made self-contained, since from the

point of view of method their results belong to two fields of statistics, each of which is used in different sciences. Seismologically the theoretical results constitute an improved power of discrimination, not only in order to use the censoring point, but also because of increased possibilities for considering the variables individually when estimating parameters for a stochastic model and when formulating a rule of classification from estimates and their degree of accuracy.

FOA Reports (1977), 11, 2.

T2 Collection and analysis of airborne radioactivity

(79) FOA report C40080-T2 (A1)
Radioactivity from nuclear explosions in ground-level air and precipitation in Sweden. NaI(T1) measurements from mid-year 1972 to the end of 1975 (in English)
Brita Bernström

From mid 1972 to the end of 1975 the concentrations of various fission products in ground-level air were reported from 7 Swedish collecting stations, with the fallout rates at 6 of them for ^{95}Zr and ^{137}Cs. Ground-level concentrations of ^{137}Cs attained its lowest value in 1973 since measurements began, but then slightly increased owing to the two Chinese thermonuclear tests in 1973 and 1974.

Activity ratios between different fission products are discussed, together with differences between the ratio $^{95}Zr/^{137}Cs$ at ground level and the same ratio in precipitation. The distribution of effective fallout rates for different years is examined.

A comparison is drawn between parallel measurements of NaI(T1)- and Ge(Li)-detectors covering about two years.

T3 Scientific documentation

(80) FOA report A40023-T3 (C1)
Computerised literature search to monitor technical and scientific developments in agents of chemical warfare - a study in method
Ingela Byfors et al April 1978

The Report describes the design and efficiency of two search profiles for searching a computerised literature reference system. These profiles are considered to be suitable for searching current databases continuously and with little effort in manpower, in order to find references to potential agents of chemical warfare, with a high success rate ($p > 0.8$).

It will be possible to use the profiles and search systems as one method among several of giving the signatories to some eventual agreement to ban the development, production and storage of means of chemical warfare, confidence in the observance of such agreement. The problems surrounding the verification of

an international disarmament agreement on means of chemical warfare are not touched upon in the Report.

This Report represents the conclusion to an investigation initiated in 1973, extracts of which have previously been submitted in interim Reports.

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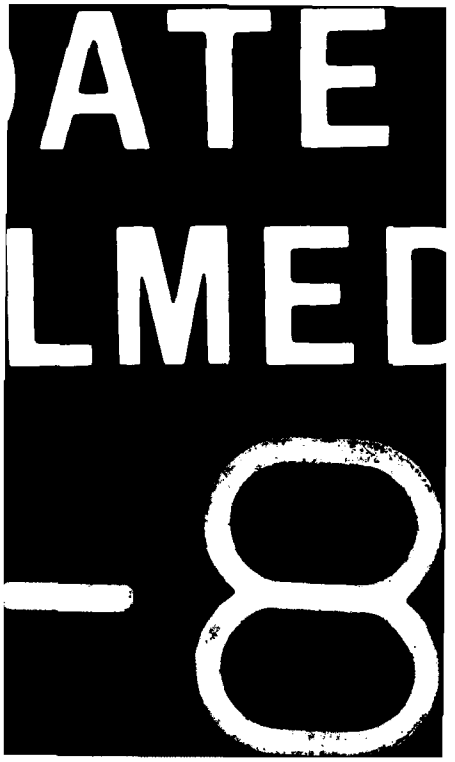
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